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Cathode-Ray Tube Display Apparatus

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(73) Inventor: Taturo YAMAZAKI c/o Nippon Dennki Home-Electronics Kabushiki Kaisha 5-24, Miyahara 3-Chome, Yodogawa-Ku, Ohsaka-Shi, Ohsaka-Fu

(71) Applicant: Nippon Dennki Home-Electronics Kabushiki Kaisha 4-24, Johken 1-Chome, Tyuoh-Ku, Ohsaka-Shi, Ohsaka-Fu

(74) Agent: Patent Attorney, Nobuyuki KUDO, two (2) others

SPECIFICATION

1. Title of the Invention

Cathode-Ray Tube Display Apparatus

2. Claim

A cathode-ray tube display apparatus, for storing data for use of display control (hereinafter, "display control use data"), which is determined for each of different kinds of video signals, in advance, wherein the video signal inputted is discriminated on the kind thereof,

so as to take out the display control use data corresponding thereto, thereby controlling each of means, depending upon the data taken out, for displaying the inputted video signal thereon, comprising:

a first adjustment means, for storing standard data of said display control use data for each kind of the video signals, in advance, so as to take out the standard data of the display control use data for said kind, thereby conducting a display operation, when a mode is instructed for adjusting a first kind of the video signal, also for revising the standard data depending upon revision amount data given from an input operation means, to be stored as the display control use data, as well as, for forming roughly adjusted display control use data, by revising also other kinds of the video signals depending upon said revision amount data, to be stored therein; and

a second adjustment means for taking out the display control use data of a kind that is roughly adjusted, when a mode is instructed for adjusting said kind of the video signal, other than said first kind thereof, thereby conducting the display operation, and for revising the roughly adjusted display control use data depending upon the revision amount data, which is given from said input operation means, to be stored as the finally adjusted display control use data therein.

3. Detailed Explanation of the Invention

[Field of Utilization in Industries]

The present invention relates to a cathode-ray tube (CRT) display apparatus, and in particular, to that being applicable to a display apparatus, preferably, which can display different kinds of video signals thereon.

[Prior Art(s)]

Recently, various kinds of information processing apparatuses (for example, personal computer apparatuses) are widely spreading, and there are many cases where the format of a video signal outputted therefrom differs, for each of the various kinds of the information processing apparatuses. For this reason, there was already proposed such a CRT display apparatus that can display the various kinds of video signals thereon.

However, the reason for that the video signal differs in the kind thereof lies due to the facts, for example; first of all, that a synchronizing signal is separated or not, from the video signal (i.e., being so-called a separate synch or not), or that it is composed within the video signal or not (i.e., forming a composite video signal or not); secondly, depending upon the polarity of synchronizing signal; and thirdly, the differences in the horizontal or/and vertical synchronization frequencies.

In order to display such plural kinds of the video signals, with the conventional CRT display apparatus, a synchronization deflection unit and/or a video processor unit are provided, separately, for each kind of the video signals, and those units are switched to be used therein. Also, though the synchronization deflection unit or the video processor unit is one (1) piece, however the values of control signals for those units are altered, so as to change operating characteristics thereof, thereby achieving display of the plural kinds of video signals.

Herein, the control signals to be applied to the synchronization deflection unit and the video processor unit are memorized as digital data corresponding for each kind thereof, while detection is made on the kind of the video signal arriving thereto, so as to take out the data relating to that kind thereof; therefore, they are formed through

conducting the digital/analogue conversion upon that data taken out. Accordingly, for each of those kinds, the display control use data is stored, in advance.

[Problem(s) to be Dissolved by the Invention]

On a while, an optimal value of the display control use data is determined depending upon an each kind, and it differs from for the each kind. However, due to variation or fluctuation between the products of the CRT display apparatus, the optimal value also differs from, depending upon the product, even if the data is for the same kind of video signal.

Then, at the time when shipping the products, it is necessary to make adjustment on the display control use data for each of the products.

However, for the CRT display apparatus, displaying different kinds of video signals thereon, since the video signals targeted are large in the numbers thereof, or since the display control use data are large in the kinds thereof, then much time and a large amount man-hour are taken for that operations or works for that adjustment.

Such the disadvantage is also caused, not only at the time when shipping, but also at the time when making a maintenance, in the similar manner.

The present invention is accomplished by taking such the aspects as was mentioned above into the consideration, and an object thereof is to provide a CRT display apparatus, enabling adjustment/set-up of the display control use data for obtaining a display, depending upon the kind of the video signal inputted, at the optimal value thereof within a short time-period.

[Means of Dissolving the Problem(s)]

For dissolving such the problems, according to the present invention, there is provided a cathode-ray tube display apparatus, for storing data for use of display control, which is determined for each of different kinds of video signals, in advance, wherein the video signal inputted is discriminated on the kind thereof, so as to take out the display control use data corresponding thereto, thereby controlling each of means, depending upon the data taken out, for displaying the inputted video signal thereon, comprising: a first adjustment means, for storing standard data of said display control use data for each kind of the video signals, in advance, so as to take out the standard data of the display control use data for said kind, thereby conducting a display operation, when a mode is instructed for adjusting a first kind of the video signal, and for revising the standard data depending upon revision amount data given from an input operation means, to be stored as the display control use data, as well as, for forming roughly adjusted display control use data, by revising also other kinds of the video signals depending upon said revision amount data, to be stored therein; and a second adjustment means for taking out the display control use data of a kind that is roughly adjusted, when a mode is instructed for adjusting said kind of the video signal, other than said first kind thereof, thereby conducting the display operation, and for revising the roughly adjusted display control use data depending upon the revision amount data, which is given from said input operation means, to be stored as the finally adjusted display control use data therein.

[Function]

The present invention relates to the cathode-ray tube display apparatus, enabling displays of the different kinds of video signals,

wherein, for the purpose of displaying the different kinds of video signals, there are stored display control use data, to be determined for each of the kinds, and discrimination is made on the kind of the video signal inputted, so as to take out the display control use data corresponding to that kind, to be provided to each means, thereby displaying that kind of the video signal thereon. Namely, in the display apparatus, accomplished by the present invention, the each means is used in common with the plural kinds of video signals, however the characteristic value at that time is changed depending upon the display control use data, for corresponding to the difference of the kind.

And, according to the present invention, it is characterized by an adjustment structure for storing an optimal value of the display control use data in advance.

A first adjustment means stores standard data of said display control use data for each kind of the video signals, in advance, so as to take out the standard data of the display control use data for said kind, thereby conducting a display operation, when a mode is instructed for adjusting a first kind of the video signal, also revising the standard data depending upon revision amount data given from an input operation means, to be stored as the display control use data, and it further forms roughly adjusted display control use data, by revising also other kinds of the video signals depending upon said revision amount data, to be stored therein.

A second adjustment means takes out the display control use data of a kind that is roughly adjusted, when a mode is instructed for adjusting said kind of the video signal, other than said first kind thereof, thereby conducting the display operation, and it revises the roughly adjusted display control use data depending upon the revision amount

data, which is given from said input operation means, to be stored as the finally adjusted display control use data therein.

Through adjustment by means of those adjustment means, it is sufficient that an adjustment is made from the display control use data, which was roughly adjusted, when adjusting the video signals of the kinds other than the first one; therefore, comparing to the conventional arts, it is possible to reduce the time and the steps for adjusting.

[Embodiment]

Hereinafter, detailed explanation will be made about one embodiment, according to the present invention, by referring to drawings.

Fig. 2 is a block diagram for showing the structure of this embodiment. In Fig. 2, a CRT display apparatus 20 of this embodiment is provided with the video signal from a video signal generator source 10 made of, such as, a personal computer, etc., for example, in the form of being divided with the synchronizing signal therefrom, or in the form of being composite therewith.

This CRT display apparatus 20 comprises an interface unit 21, a video processor unit 22, a synchronization deflection unit 23, a CRT unit 24 and a high voltage unit 4.

The interface unit 21 provides the video signal to the video processor unit 22, among those signals provided from the video signal generator source 10, while it provides a synchronizing signal to the synchronization deflection unit 23.

The video processor unit 22 treats various kinds of processes, such as, amplification, etc., upon the video signal inputted, thereby to apply it to a cathode of the CRT portion 24. The synchronization

deflection unit 23 deflects electron beams emitted from the cathode of the CRT portion 24, depending upon the synchronizing signal inputted. The high voltage unit 25 supplies high voltage to the CRT portion 24, which is necessary for controlling the electron beams emitted from the cathode of the CRT portion 24, or accelerating it and so on.

In addition to such the basic structure for achieving the display as was mentioned above, there is further provided a mechanism for controlling the display, appropriately, corresponding to a kind of the video signal inputted. Namely, there are provided a control unit 26, an already-adjusted data memory 28, a digital/analog (D/A) converter unit 30, a user control switch unit 31 and an encoder unit 32.

However, other than the processes mentioned above for such the control, the interface unit 21 mentioned above discriminates the kind of the video signal, so as to provide a discrimination code signal to the control unit 26.

The control unit 26 is constructed with, such as, a microcomputer storing programs therein, for example. The control unit 26 carries out a control on measuring the frequency of the synchronizing signal provided from the interface unit 21, with utilizing a working memory 29 made of a RAM, in the form of digital data, under a normal operation mode (there is also an adjustment mode, as an operation mode opposing thereto, which will be mentioned later), thereby outputting the frequency data to the D/A converter unit 30, and also a control of taking out data for use of a display control (i.e., "display control use data"), corresponding to the discrimination code signal provided from the interface unit 21, from the already-adjusted data memory 28, thereby outputting it to the D/A converter unit 30.

The already-adjusted data memory 28 is made of a re-writable

and non-volatile memory, such as, an EEPROM, for example, and as was mentioned above, there is stored the display control use data, being already adjusted, corresponding to plural numbers of kinds of the video signals. However, those data will be adjusted as will be mentioned later.

The D/A converter unit 32 converts the frequency data and the display control use data into analog signals, so as to supply them to a circuit of an each portion, within the video processor unit 22 and the synchronization deflection unit 23.

Herein, the frequency data means the measurement data of the horizontal synchronization frequency and the vertical synchronization frequency, and the display control use data means the data for use of a horizontal screen position, a horizontal screen size, a vertical screen position, a vertical screen size, a contrast of the screen, a brightness and a compensation of screen distortion, etc.

With using such the frequency data and/or the display control use data, control is made upon the circuit characteristics inside the video processor unit 22 and the synchronization deflection unit 23, thereby enabling displays of the plural kinds of the video signals.

The user control switch unit 31 comprises plural numbers of switches, and a user can operate any one of the switches or more than that, so as to obtain a screen at her/his desire while watching on the display screen. The data from this unit 31 instructs an amount of change on the display screen from the present condition.

The encoder unit 32 outputs instruction data (or code) corresponding to the switch of the user control switch unit 31, which is pushed down, to the control unit 26. The control unit 26 changes the data to be applied to the D/A converter unit 30 by an amount of

this instruction data under a normal operation mode.

By the way, even for the CRT display apparatuses of having the same specification, however the optimal value of the display control use data differs from each other, due to fluctuation of the actual products. For this reason, as was mentioned above, into the already-adjusted data memory 28 are stored such the data, being adjusted for each of the products, in advance.

Accordingly, on the said CRT display apparatus, there is also provided the structure for making an adjustment.

Though the each unit mentioned above is able to function when making the adjustment, however there are units to be used only under the adjustment mode. Thus, there are provided a standard data memory 27 and a mode determination port 33.

The mode determination port 33 is provided for taking a signal indicative of an adjustment mode from an outside, to be applied to the control unit 26.

The control unit 26 is the structure unit for carrying out the following processes, from a viewpoint of the adjustment mode. Thus, first of all, it carries out a process of taking out the standard data of the display control use data from the standard data memory 27, thereby to output it to the D/A converter 30. Second, it carries out a process of taking the instruction data therein, upon which the user makes adjustment with the user control switch unit 31, through the encoder unit 32, so as to change the standard data by an amount of that instruction data, to be outputted to the D/A converter unit 30. Third, it carries out a process of writing the data at that time into the already-adjusted data memory 28 when completing an instruction from the user. Fourth, it carries out a process of producing a sort or kind of once-adjusted

(i.e., roughly adjusted) data of other kinds of the video signals, from the already-adjusted data, corresponding to the kind of video signal that the user directly instructs, or the instruction data at that time.

The standard data memory is constructed with, such as, a ROM, for example, and as was mentioned above, it stores therein the standard data of the display control use data, for each of the various kinds of video signals. Herein, as the standard data is used a value determined from the specification (such as, a central value in a permissible region of the specification) or an averaged value of the data obtained about plural numbers of the products in the past.

Under the adjustment mode, the user control switch unit 31 is used for instructing an amount for changing the standard value data. Namely, it is used for producing the display control use data.

Of course, the instruction from the user control switch unit 31 to the control unit 26 is given through the encoder unit 32 in the form of control data.

Next, explanation will be made about a process, which the control unit 26 executes, by referring to Fig. 1.

The control unit 26 starts the process of Fig. 1, through turning-on of an electric power source, and first of all, it conducts an initializing process (steps SP 1 and SP2); such as, turning various kinds of flags and data to the initial values thereof, and/or taking out various kinds of the last data, which are saved into a non-volatile memory (not shown in the figure, and it is also possible to utilize the adjusted data memory 28 for it) when the electric power source is cut off (in Fig. 1, the process is omitted when cutting off the electric power source), thereby setting them into a working memory

29, etc.

Next, measurement is made upon the frequency of the synchronizing signal relating to the video signals arriving thereto, and also the frequency data up to the time just before is taken out from a frequency data storing area of the memory 29, thereby detecting upon change width or breadth of the frequency (steps SP3 through SP5). Thereafter, it is determined on whether this change breadth is equal to or greater than a predetermined value or not (step SP6). Thus, it is determined on whether the frequency deference is larger than the predetermined value or not, between the detection timings of frequency at front and back for each other. As a result of such the determination, if it is determined that it comes to be larger, the frequency data which has been just measured is outputted into the D/A converter unit 30, thereby to be stored as that frequency data just after the measurement into the frequency data storing area of the memory 29 (step SP7 and SP8).

When renewing the frequency data in this manner, or when determining that the change breadth in the frequency is not so large as the predetermined value, then the process moves into the following steps, which do not relate to the frequency data.

Herein, the predetermined value, to be used for determining on whether the renewal of the frequency data is necessary or not, is selected at the value thereof, so that the renewal will not be executed on the frequency data, responding to an instantaneous turbulence, such as, due to noises and/or a non-instinctive fluctuation of the input frequencies. Namely, it is so selected at a degree thereof, that the circuits within the video processing unit 22 and/or the synchronization fluctuation unit 23 can be prevented from being exchanged, frequently and aimlessly, due to such the noises. Comparison with such the

predetermined value means that, a so-called dead band is provided in measurement of the frequency.

When completing the control upon the frequency data, then the control unit 26 determines the kind of the video signal inputted (step SP9). Then, it compares it to the kind determined in the determination at previous time, thereby determining on whether the kind is changed or not (step SP10). As a result thereof, if the kind of the video signal inputted is changed, the already-adjusted display control use data is taken out, relating to the signal of a new kind that is detected, from the already-adjusted data memory 28, thereby outputting it into the D/A converter unit 30, as well as, storing it into the display control use data storing area of the working memory 29 (steps SP11 and SP12).

When the kind of the video signal inputted is not changed, and also when renewal is made on the display control use data corresponding to the change of that kind, then next, it is determined on whether the adjustment mode is instructed or not; i.e., which one of the normal operation mode or the adjustment mode is instructed or not, through the mode determination port 33 (step SP13).

As a result of such the determination, if it is determined that the normal operation mode is instructed, then it is further determined on whether the code is given or not from the encoder 32 (step SP14). Namely, it is determined on whether the user operates or not upon any one of switches, which belong to the user control switch unit 31. As a result thereof, if it is determined that the user does not make the control operation, then the process turns back to the frequency measurement process of the step SP3 mentioned above. On the other hand, if it is determined that the user executes the control operation, the

display control use data is changed by an amount of that operation, to be outputted into the D/A converter unit 30, and at the same time, the data changed is stored into the display control use data storing area of the working memory 29 (steps SP15 and SP16).

Accordingly, during the time-period when no adjustment mode is instructed, the control unit 26 repeats a loop process made of the steps SP3 through SP14, or other loop process made of the steps SP3 through SP16.

If the operator instructs the adjustment mode through the mode determination port 33 from an outside, for adjustment at the time when shipping and/or at the time when making maintenance, and when the control unit 26 determines that the adjustment mode is instructed from (see the step SP13), it further determines on whether an initial adjustment flag is at the level or not, being indicative of completion of an initial adjustment (step SP20). Herein, the initial adjustment means the first adjustment that is conducted for an arbitrary one (1) kind of the video signal, after the adjustment mode is selected. A reason for providing such the determination lies in, because the first adjustment of the kind differs from the adjustment of other kind of the input signal to be conducted thereafter, a little bit. However, the initial adjustment flag is set at the level, being indicative that the initial adjustment in not yet completed, in the initializing process (see the step SP2).

If the initial adjustment flag indicates that the initial adjustment in not yet completed, then the control unit 26 takes out the standard data of the display control use data corresponding to the video signal that is under processing thereof, thereby to be outputted into the D/A converter unit 30 (steps SP21 and SP22). With doing this, a display screen is displayed on the CRT portion 24, which is obtained

by treating the standard display control upon the video signal of the kind of being under inputting thereof.

While watching this display screen, the operator can operate the switches belonging to the user control switch unit 31, so as to bring the display screen to be preferable. At this instance, the control unit 26 changes the control use data to be given to the D/A converter unit 30 depending upon the data from the encoder unit 32, and when no code is provided from the encoder unit 32; i.e., when the operator finished the adjustment operation, it stores the display control use data into the area of the adjusted data memory 28 relating to the video signal of that kind, to be as the optimal data in relation to the video signal of the kind, at that time (step SP23).

Thereafter, data is obtained about the difference between the standard data and the already-stored optimal data (step SP24). Next, the control unit 26 takes out the standard data in relation to the other kind video signal from the standard data memory 27, so as to amend the standard data taken out depending upon the difference data that is obtained in the process mentioned above, and stores it into the area of each kind in the already-adjusted data memory 28, to be as the data once-adjusted for that kind of video signal (i.e., the roughly adjusted data) (steps SP25 and SP26).

Herein, a different method is applied therein, as the amending method thereof, depending upon the kind of the display control use data. For example, if it relates to the horizontal screen position and/or the vertical screen size, for example, the difference between the standard data themselves due to the difference in the kinds of video signals is linear; therefore, the difference data between the standard data obtained about a certain kind of video signal and the

optimal data is utilized for calculation of the other kind of an optimal data candidate, in a linear manner. Also, if it relates to the horizontal screen size, the difference data is utilized in accordance with a quadratic curve; thus, it is used for determination of the optimal data of other kind of video data, once.

In this manner, the adjustment is completed by means of one (1) piece of a kind of video signal, and upon the basis of this amount of adjustment, an amendment is make upon the standard data of other kinds of video signals, thereby determining the roughly-adjusted display control use data; then, the initial adjustment flag is turned back to the level indicative of completing the initial adjustment, and the process turns back to the step SP3 mentioned above (step SP27).

After obtaining the positive result in the step SP13 when the adjustment mode is instructed, if it is determined that the initial adjustment is completed at the step of determination upon the initial adjustment flag, then the control unit 26 reads out the roughly-adjusted display control use data relating to the kind of video signal of being under inputting thereof, so as to output it to the D/A converter unit 30 (step SP30 and SP31).

While watching on the display screen at that time, the operator can operate the switches belonging to the user control switch unit 31, so as to bring the display screen to be preferable (but, including also the case where no adjustment is made), at this instance, the control unit 26 changes the control use data to be given to the D/A converter unit 30 depending upon the code from the encoder unit 32, and when no code is provided from the encoder unit 32, i.e., when the operator completes the adjustment operation, it stores the display control use data at that time into the area for the adjusted data memory relating

to that kind of video signal, to be as the finally-adjusted data in relation to the video signal at that time (steps SP32 and SP33). Thereafter, the process turns back to the step SP3 mentioned above.

Through the processing made up with such the steps SP30 through SP33, it is possible to obtain the final adjusted data of one (1) kind of video signal from those, but other than that, which are already-adjusted in the initial adjustment. In actual, the final adjusted data for each kind of the video signal is determined with using this processing system.

Herein, since the adjustment made up with the steps SP30 through SP33 is made, after the initial adjustment process (steps SP21 through SP27), then the once-adjusted data is/are further adjusted for those kinds of the video signals, which are not yet the objects of the initial adjustment, and therefore the adjustment can be made easily.

Accordingly, with the embodiment mentioned above, comparing to the conventional arts, the adjustment can be executed upon the display control use data for large numbers of kinds of the video signals, with ease and in a short time, when shipping and/or making maintenance of each product.

Further, in the embodiment mentioned above, although the CRT display apparatus is shown for use in the information processing apparatus, however it can be also applied to the CRT display apparatus for use of receiving the television broadcasting and/or the CRT display apparatus for use in both the television broadcasting and the information processing apparatus. This is because, in recent years, plural number formats appear also for the television signal (such as, the NTSC method and the high-vision method).

[Effect of the Invention]

As was mentioned in the above, according to the present invention, it is possible to make the adjustment upon the optimal value of the display control use data to be stored in advance for each of plural kinds of the video signals, in a short time-period and with ease, comparing to the conventional art. Also, there can be obtained a CRT display apparatus, adjustment of which can be achieved with a small numbers of steps.

4. Brief Description of Drawings

Fig. 1 is a view for showing an interface control method, according to one embodiment of this invention. Fig. 2 is a view for showing a conventional interface control method. Fig. 3 is a view for showing interface timings of those.

10...video signal generator source, 20...CRT display apparatus, 21...interface unit, 22...video processor unit, 23...synchronization deflection unit, 24...CRT portion, 25...high-voltage unit, 26...control unit, 27...standard data memory, 28...adjusted data memory, 29...working memory, 30...D/A converter unit, 31...user control switch unit, 32...encoder unit, 33..mode determining port

Applicant

Nippon Dennki Home-Electronics Kabushiki Kaisha

Fig. 1

START
(TURN ELECTRIC POWER ON)
INITIALIZATION
MEASURE FREQUENCY ON INPUT SYNCH SIGNAL
READ-OUT OLD FREQUENCY DATA
DETECT CHANGE ON FREQUENCY
IS CHANGE EQUAL/GREATER THAN PREDETERMINED?
OUTPUT NEW DATA
STORE NEW DATA
DETERMINE VIDEO KIND
IS KIND CHANGED?
READ-OUT DATA
OUTPUT DATA
DETERMINE CONTROL MODE?

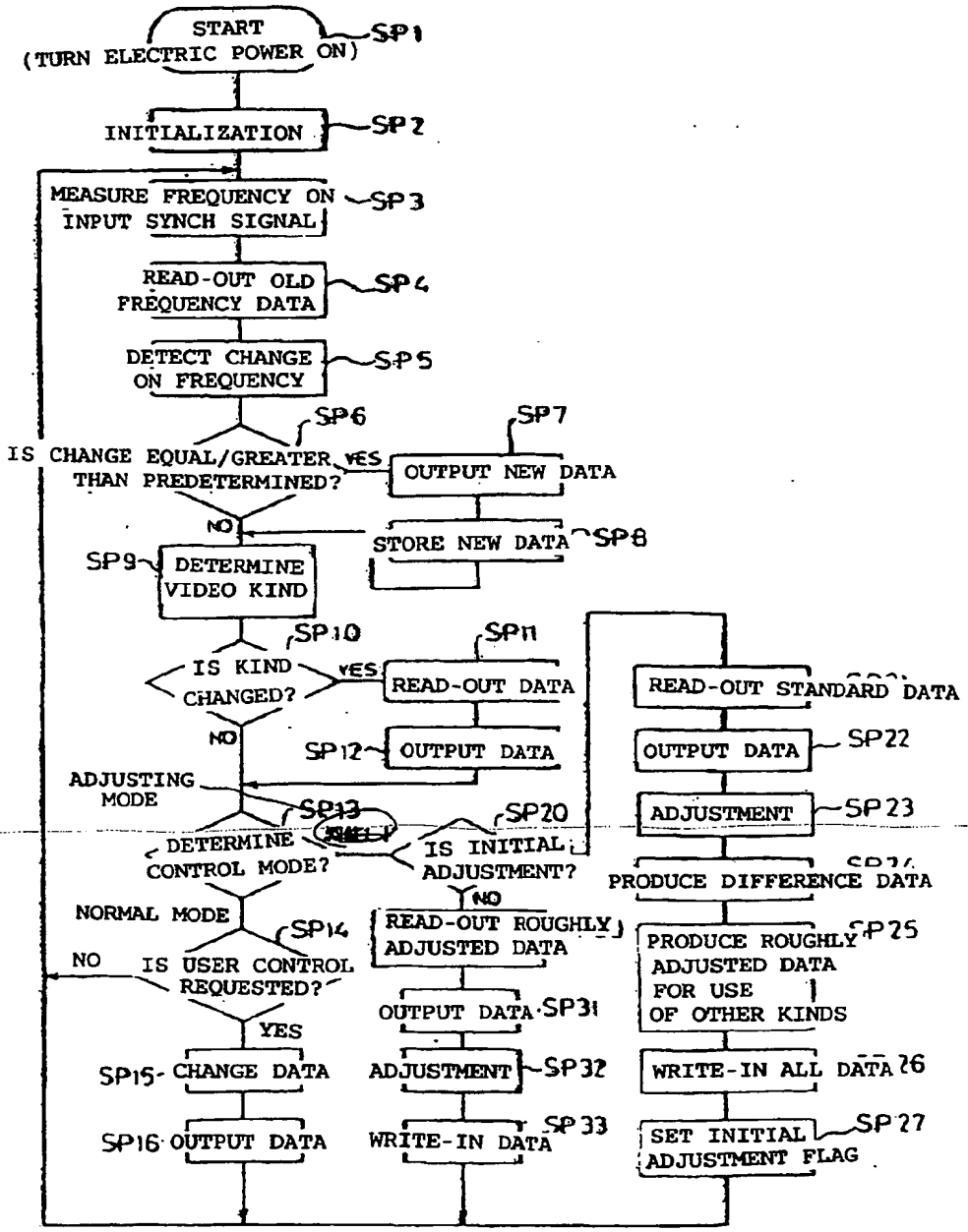
NORMAL MODE
ADJUSTING MODE
NO YES

IS USER CONTROL REQUESTED?
CHANGE DATA
OUTPUT DATA
IS INITIAL ADJUSTMENT?
READ-OUT ROUGHLY ADJUSTED DATA
OUTPUT DATA
ADJUSTMENT
WRITE-IN DATA
READ-OUT STANDARD DATA
OUTPUT DATA
ADJUSTMENT
PRODUCE DIFFERENCE DATA
PRODUCE ROUGHLY ADJUSTED DATA FOR USE OF OTHER KINDS
WRITE-IN ALL DATA
SET INITIAL ADJUSTMENT FLAG
PROCESSING IN THE CONTROL UNIT OF THE EMBODIMENT

Fig. 2

VIDEO SIGNAL GENERATING SOURCE
INTERFACE UNIT
VIDEO PROCESSOR UNIT
CRT PORTION

HIGH-VOLTAGE UNIT
MODE DETERMINATION PORT
ENCODER UNIT
CONTROL UNIT
(MICROCOMPUTER)
D/A CONVERTER UNIT
USER CONTROL SWITCH UNIT
SYNC DEFLECTION UNIT
STANDARD MEMORY UNIT
ALREADY-ADJUSTED DATA MEMORY
WORKING MEMORY
CRT DISPLAY APPARATUS
STRUCTURE OF THE EMBODIMENT



PROCESSING IN THE CONTROL UNIT OF THE EMBODIMENT

Fig. 1

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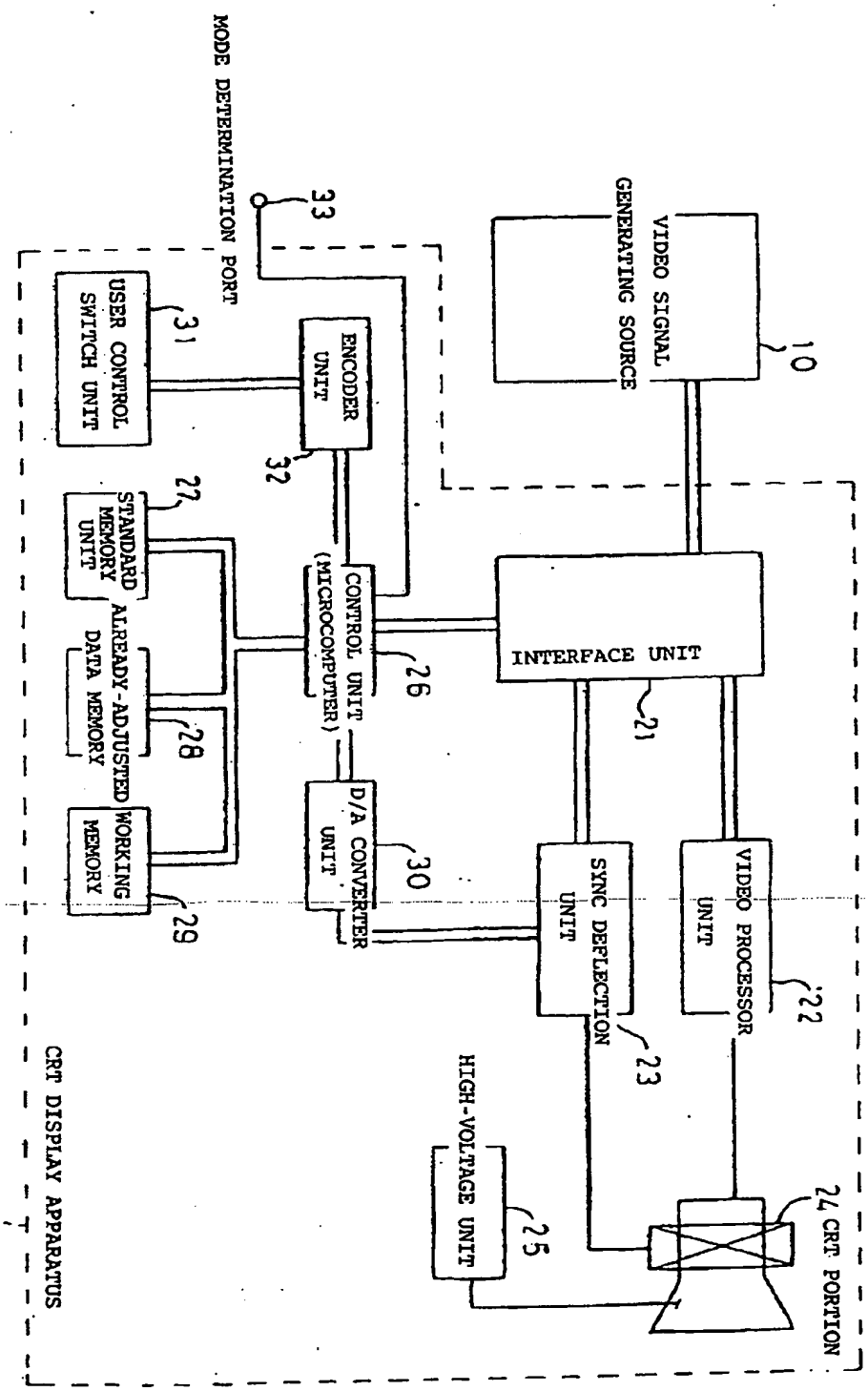

STRUCTURE OF THE EMBODIMENT

Fig. 2